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Advanced Planning Briefing for Academia

APBA

Intelligent Ground Systems

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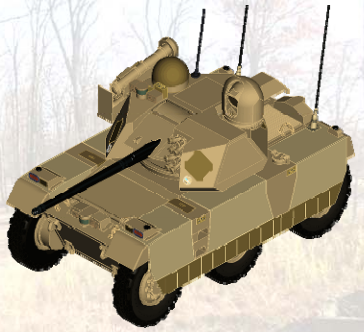
Intelligent Ground Systems Overview



Furthering Unmanned Systems Autonomy

- Unmanned Ground Vehicle Platforms
- Vehicle Intelligence and Control
- Mission Payload Integration
- Embedded Simulation

Increasing Crew Interface and Control Capabiliti

- Human-Robot Interaction
- Advanced Soldier Machine Interfaces
- Embedded Simulation

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TARDEC Robotics

Mission

Integrate, Explore, and Develop Robotics, Network and Control Components with a Focus on Customer Driven Requirements to Provide Full System Solutions to the War Fighter

Technology Components

Integration

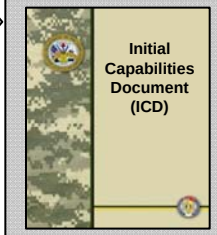
Demonstrators

SME Defined Scenarios

Military Relevant Test & Experimentation

Tech Transfer

Transition and Requirements Development



Integration Technology Development Lessons Learned to Enable Early Technology Insertion

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Enabling Technologies

Making the robots work well with others

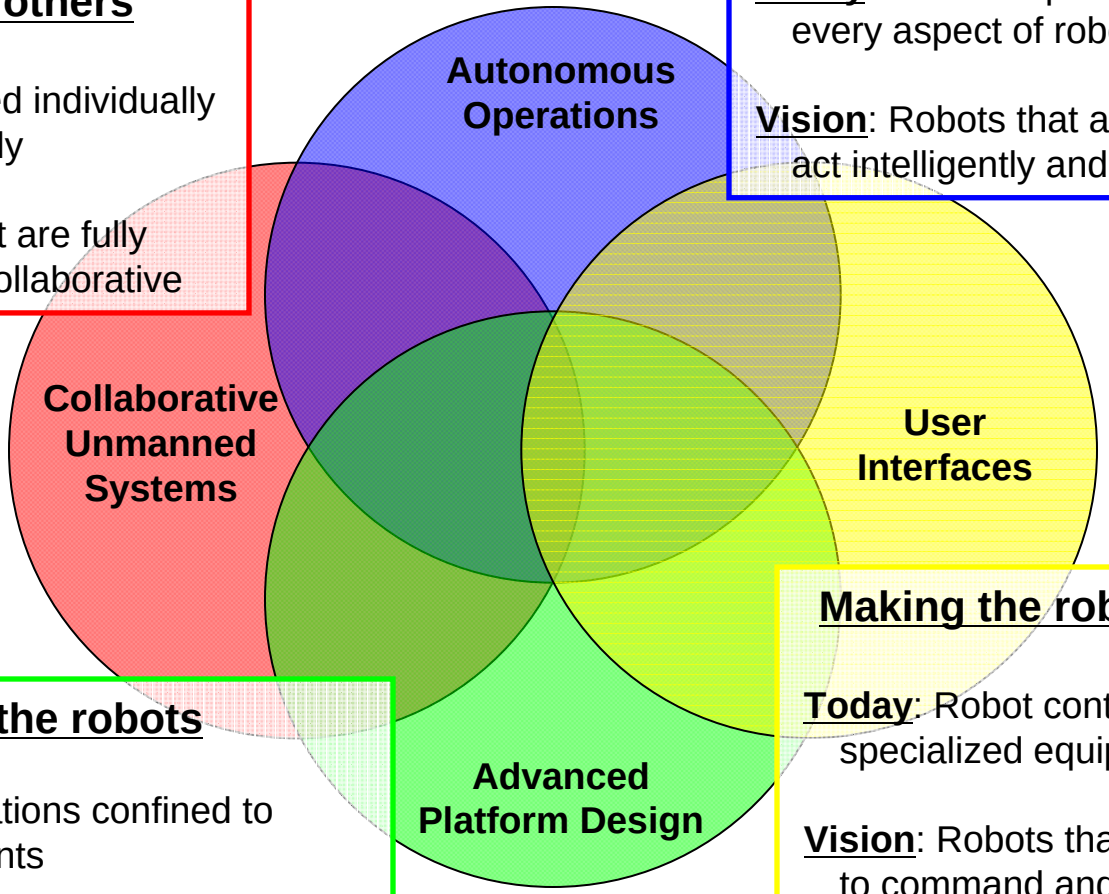
Today: Robots used individually and independently

Vision: Robots that are fully networked and collaborative

Making the robots smarter

Today: Human input required to control every aspect of robot

Vision: Robots that are able to think and act intelligently and independently



Making the robots

Today: Robot operations confined to limited environments

Vision: Robots that are able to operate in any environment at any time

Making the robots easier to use

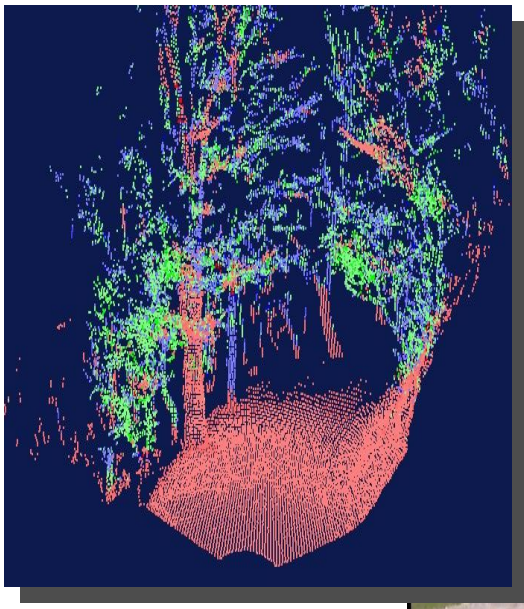
Today: Robot control requires specialized equipment and training

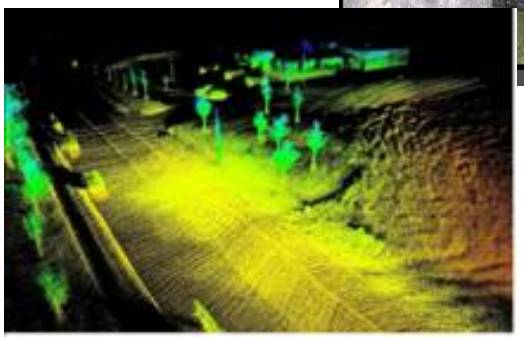
Vision: Robots that are intuitively easy to command and control

Unmanned Systems Technology Shortfalls - Perception

Research Topics – Potential Shortfalls

- Sensors – extended range & resolution
- Sensors – all weather sensing/obscurants
- Sensors – reduced size
- Software – Terrain classification, especially at extended range
- Software – Feature classification, especially at extended range
- Software – Detection, classification, tracking of moving vehicles, people, & animals from a moving vehicle (object association/partial obscuration)
- Software – Detection of moving & stationary people, often partially obscured or camouflaged
- Software – Stand-off classification of mud or water – estimate of surface supportability/ trafficability





Research Topics – Potential Shortfalls

Vehicle Intelligence

- Ability to adapt to changing environment & learn from prior experience or act based upon general guidance
- Ability to project future activity or courses of action by others and plan accordingly
- Ability to understand vehicle health and modify plans accordingly

Tactical Behavior

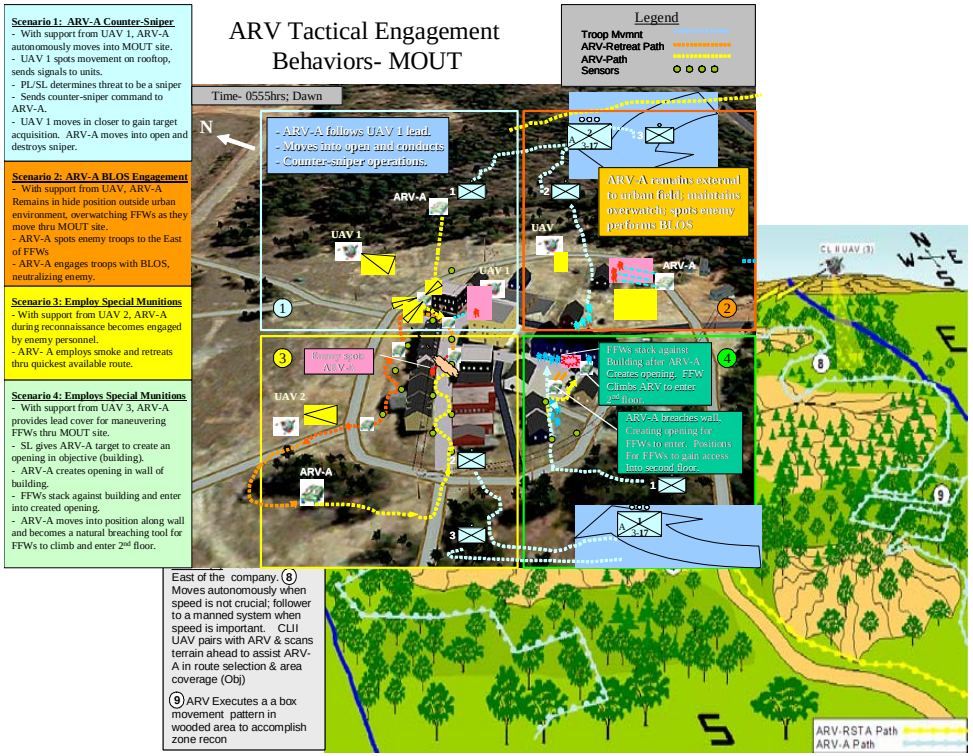
- Mimic the behavior of Soldiers under similar conditions
- Continue autonomous operation during prolonged communications outages
- Self-protection

Collaboration

- Shared situational awareness
- Teaming – robot/robot and robot/Soldier

Mission Specific Behaviors

- RSTA
- Force Protection
- Material handling/delivery



Unmanned Systems Technology Shortfalls - Command and Control

Research Topics – Potential Shortfalls

Operator Control

- Situational awareness of what's going on around the robot/operator intervention
- Scalable interfaces – from MGV to dismount
- Operator workload in realistic tactical environments
- Operator span of control
- Alternative control modes (voice/gesture)
- Hands free, heads up display and control

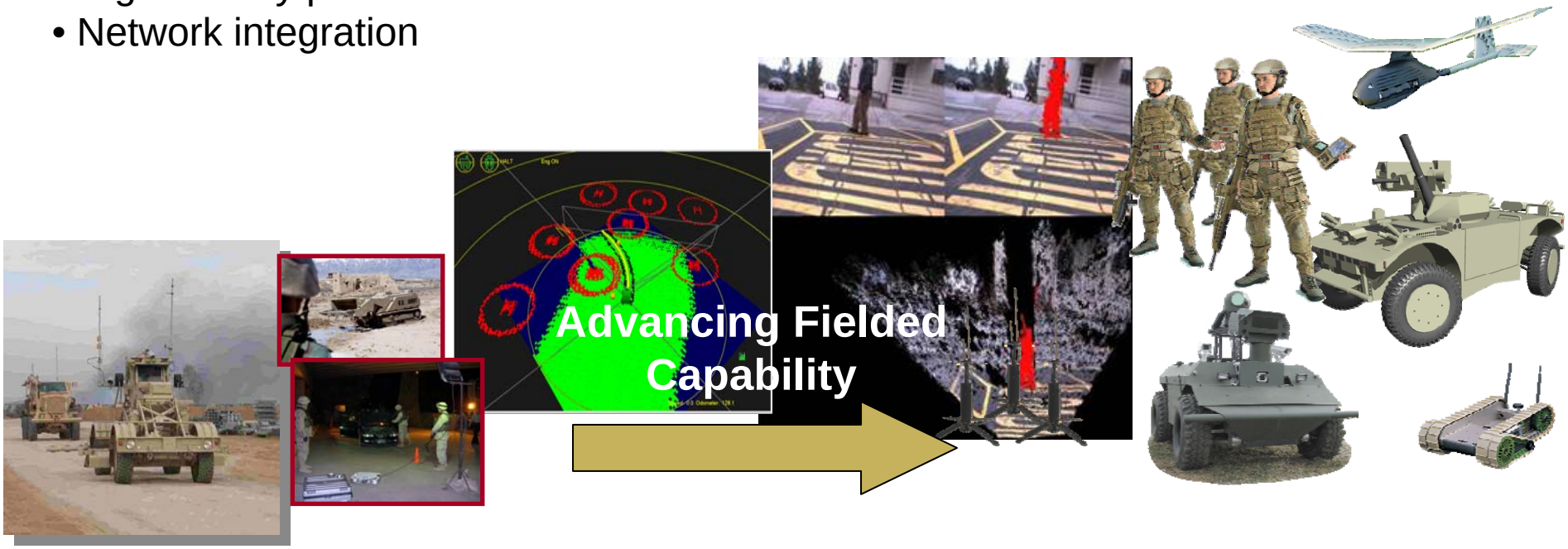
Command Integration

- Fusion of local situation awareness information with the Common Operating Picture

Systems Shortfalls

Research Topics – Potential Shortfalls

- Autonomous Vehicle safety
- Autonomous Weapon safety
- Platform – modularity; shape shifting; micro/miniaturization; bio-mimetic; health maintenance/ prognostics/ self-healing;
- Low SWAP, high bandwidth data links
- High density power sources
- Network integration



Hard On and Off Road Problems

- Very busy environments
- Potholes
- Other vehicles
- Poor lane markings
- Traffic signals
- Pedestrians
- Animals
- Road work
- Deep water
- Very cluttered environments
- Mud, ice, snow, gravel and other traction problems
- Sharp rocks, rebar and curbs
- Tank traps
- Wire, posts and fences
- Hidden hazards, e.g. rocks and holes
- Fog, dust, smoke, rain

Examples of what Co-op Students are doing in Intelligent Systems

- **Operator Control Units**
- **Hyperspectral Scene Segmentation**
- **Head Mounted Display**
- **Human Detection and Localization**
- **Novel Platform Development**
- **Robotic Path Planning**